

Listing of Claims:

1. (Currently Amended) A method of forming a hollow stepped shaft, ~~characterized in that it comprises~~
comprising the steps of:

holding an upper and a lower part axially of a solid
5 rod-like blank with an upper and a lower die,
respectively, which have a stepped recess of large
diameter in a region thereof where they are opposed to
each other;

compressing the blank from both its axially opposite
10 sides with an upper and a lower punch each of which is
smaller in diameter than the blank and at least one of
which is moving, thereby extruding the blank so that an
axial hollow is formed therein about its axis in each of
said upper and lower parts and that a portion of the blank
15 opposed to said stepped recess of large diameter expands
in diameter and deforms into said recess while leaving a
solid plug-like portion between said punches; and
thereafter

further compressively moving one of said punches to
20 shear said solid plug-like portion and force it out of the
blank,

whereby said blank is formed with a stepped portion

of large diameter by radially expanding deformation in a region intermediate between its opposed ends or at one of these ends and with a continuous axial hollow about its axis, thereby forming a hollow stepped shaft.

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2. (Currently Amended) A method of forming a hollow stepped shaft as set forth in claim 1, ~~characterized in that~~ wherein said solid rod-like blank is loaded into said upper and lower dies which are in a closed die-fastened state and thereafter extrusion of the blank is performed with said punches.

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3. (Currently Amended) A method of forming a hollow stepped shaft as set forth in claim 1, ~~characterized in that~~ wherein said solid rod-like blank is loaded into said upper and lower dies which are in an open die-unfastened state and thereafter extrusion of the blank are performed with said punches while said dies are being closed and fastened.

4. (Currently Amended) A method of forming a hollow stepped shaft as set forth in ~~claim~~ any one of claims 1 to 3, ~~characterized in that~~ wherein the method further comprises ~~the~~ a further step wherein a hollow stepped

5 shaft so formed as aforesaid is further formed in another die set to impart an additional outer contour thereto.

5. (Currently Amended) A method of forming a hollow stepped shaft as set forth in claim 4, ~~characterized in that~~ wherein in said further step, said additional outer contour is imparted to the hollow stepped shaft with a
5 mandrel inserted therein.

6. (Currently Amended) A method of forming a hollow stepped shaft, ~~characterized in that it comprises~~ comprising the steps of:

5 supporting a solid rod-like blank at its first end with a bearer while its outer periphery is bound and extruding the blank about its axis from its second end with a first punch so as to form an axial hollow therein about the axis; and

10 extruding the hollow blank forwards and backwards with a second and a third punch so as to form the hollow blank in a region thereof intermediate between the first and second ends or at one of these ends with a stepped portion enlarged in both diameter and thickness while simultaneously making the blank longer.

7. (Currently Amended) A method of forming a hollow stepped shaft as set forth in claim 6, ~~characterized in that~~ wherein the blank is extruded about its axis with the first punch to form the axial hollow while the bearer supporting the blank at the first end is resiliently supported by a hydraulic or pneumatic means.

8. (Currently Amended) A method of forming a hollow stepped shaft as set forth in claim 6, ~~characterized in that~~ wherein the blank is extruded about its axis to form the axial hollow by rapidly advancing the first punch while the bearer supporting the blank at its first end is allowed to move back slowly by a servo mechanism.

9. (Currently Amended) A method of forming a hollow stepped shaft, ~~characterized in that it comprises~~ comprising the steps of:

extruding a solid rod-like blank with its outer periphery bound, from its opposite sides about its axis with a first and a second punch so as to form a pair of axial hollows in its two axial parts, respectively, while leaving a solid plug-like portion of the blank between these two hollows;

compressively moving one of the punches to shear said

solid plug-like portion out of the blank whereby a single continuous axial hollow is formed from said axial hollows; and

extruding the hollow blank forwards and backwards
15 with a third and a fourth punch so as to form the hollow blank in a region thereof intermediate between its opposite ends or at one of these ends with a stepped portion enlarged in both diameter and thickness while simultaneously making the blank longer.

10. (Currently Amended) A method of forming a hollow stepped shaft as set forth in claim 9, ~~characterized in that~~ wherein said solid plug-like portion is sheared out of the blank by one of said first and second punches after
5 the other punch is extracted and while the blank is supported resiliently at one of its ends by a hydraulic or pneumatic means.

11. (Currently Amended) A method of forming a hollow stepped shaft as set forth in claim 9, ~~characterized in that~~ wherein said solid plug-like portion is sheared out of the blank by extracting one of said first and second
5 punches and thereafter rapidly advancing the other punch while one end of the blank is moved back slowly by a servo

mechanism.

12. (Currently Amended) A method of forming a hollow stepped shaft as set forth in any one of claims 6 to 11, ~~characterized in that~~ wherein the solid rod-like blank is made of carbon steel and is hollowed at a rate of
5 reduction in area of 25 % wherein the depth of the axial hollow in the blank is set at a value that is 5 times or more larger than the inner diameter which is a criterion of stable working in a cold forging and its boring regions are heated at a temperature ranging between a room
10 temperature and 700 .

13. (Currently Amended) A method of forming a hollow stepped shaft as set forth in any one of claims 6 to 11, ~~characterized in that~~ wherein the hollow stepped shaft has those regions in axial portions where serrations are
5 formed having a tooth form applied thereto by fitting or press-and-shrink fitting, which are further drawn or made smaller in diameter by multistage pressure forming with upper punches and lower dies.

14. (Currently Amended) A hollow stepped shaft formed by a method as set forth in any one of claims ~~1 to~~ ~~11~~ 1 to 3.

15. (New) A hollow stepped shaft formed by a method as set forth in any one of claims 6 to 11.

16. (New) A hollow stepped shaft formed by a method as set forth in claim 4.

17. (New) A hollow stepped shaft formed by a method as set forth in claim 5.

18. (New) A hollow stepped shaft formed by a method as set forth in claim 12.

19. (New) A hollow stepped shaft formed by a method as set forth in claim 13.